

## INLAND NAVIGATION.

## STATE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various river stations and the highest and lowest depths for April, 1887, with the dates of occurrence, and the monthly ranges:

*Heights of rivers above low-water mark, April, 1887.*  
[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.....	29.9	1	14.2	30	3.3	10.9
<i>Arkansas River:</i>						
Fort Smith, Ark.....	22.0	28	5.6	15, 16, 17, 18	0.4	5.2
Little Rock, Ark.....	23.0	29	3.7	19	1.9	1.8
<i>Missouri River:</i>						
Omaha, Nebr.....	18.0	1	13.9	29	7.4	6.5
Leavenworth, Kans.....	20.0	1	17.0	30	10.0	7.0
<i>Mississippi River:</i>						
Saint Paul, Minn.....	14.5	17	9.6	2, 3	5.5	4.1
La Crosse, Wis.....	24.0	19, 20, 21	11.9	3	5.8	6.1
Dubuque, Iowa.....	16.0	25, 26, 27	15.0	1	5.9	9.1
Davenport, Iowa.....	15.0	23, 29	11.5	1	4.7	6.8
Keokuk, Iowa.....	14.0	30	10.5	3	5.3	5.2
Saint Louis, Mo.....	32.0	3	20.5	17, 19	12.9	7.6
Calro, Ill.....	40.0	30	38.7	18, 19	18.4	20.3
Memphis, Tenn.....	34.0	30	28.7	21	15.4	13.3
Vicksburg, Miss.....	41.0	1	44.6	26, 27	22.1	22.5
New Orleans, La.....	13.0	9	15.1	30	10.1	5.0
<i>Ohio River:</i>						
Pittsburg, Pa.....	22.0	30	11.5	4, 5, 7	3.0	8.5
Cincinnati, Ohio.....	50.0	25	49.5	17	12.0	37.5
Louisville, Ky.....	25.0	26	25.9	16, 17	6.2	19.7
<i>Cumberland River:</i>						
Nashville, Tenn.....	40.0	26	17.6	17	6.2	11.4
<i>Tennessee River:</i>						
Chattanooga, Tenn.....	33.0	27	21.2	21, 22	4.2	17.0
<i>Monongahela River:</i>						
Pittsburg, Pa.....	29.0	30	11.5	4, 5, 7	3.0	8.5
<i>Savannah River:</i>						
Augusta, Ga.....	32.0	25	9.4	17	6.7	2.7
<i>Sacramento River:</i>						
Sacramento, Cal.....		11	20.5	20	19.3	1.2
<i>Willamette River:</i>						
Portland, Oregon.....		3	11.5	19	8.7	2.8

*Mississippi River.*—Saint Paul, Minn.: the first boat of the season, the steamer "Pittsburg," from Saint Louis, arrived at this port on the 20th. On the 10th the steamer "Mary Morton" had forced her way up the river as far as Reed's Landing, but, owing to ice obstructions in Lake Pepin, was unable to proceed.

*Hudson River.*—Albany, N. Y.: on the 5th the ice on the river began breaking up but gorged slightly at Pleasure Island against the upper bridge. On the 6th navigation opened, the propeller of the Chenney Towing Line arriving from New York City, and the tug "Alexandria Robertson" making the trip to Troy. On the 7th, 8th, and 9th the river was filled with flowing ice; on the 10th a gorge at the mouth of the Mohawk gave way, causing the Hudson at this point to rise rapidly, and filling it with large masses of ice. On the 11th the river had risen eleven feet since 3 p. m. of the preceding day; navigation was suspended on account of the high water, all docks being submerged. At noon of the 12th the river was fifteen feet above the low-water mark of 1876; from the 12th to 17th it subsided slowly; from the 17th to 24th it rose, and on the latter date the docks were again submerged.

*Red River of the North.*—Saint Vincent, Minn.: about the 8th and 9th the ice on the Red River began to be sensibly affected by the warm weather, becoming porous and unsafe for travel; on the 12th the water rose above the ice. The river continued rising until the 15th, when the ice broke up and moved down in large masses. On the 20th, although the river was still filled with heavy flowing ice, the ferry-boat plying between this place and Pembina, Dak., resumed her regular trips.

*Lake Erie.*—Buffalo, N. Y.: navigation opened on the 17th; the steamer "Iron Chief" cleared, and the steamers "Farwell" and "Sheriff" arrived. On the 20th, 23d, and 24th heavy southwest winds again filled the harbor with ice which impeded navigation.

*Lake Michigan.*—Escanaba, Mich.: during the latter part of

the month the ice in Green Bay broke up but it remained solid in this harbor and Little Bay de Noquet until the 28th, on this date the steamers "Manhattan" and "Progress," the latter from Cleveland, Ohio, succeeded in forcing a passage through the ice and reaching this port. On the 30th the bay was still filled with heavy floating ice which was, however, not firm enough to prevent the arrival and departure of vessels.

Milwaukee, Wis.: the steambarge "J. W. Wescott" arrived at this port on the 26th; this was the first arrival this spring from the lower lakes.

Mackinaw City, Mich.: the high wind of the 22d and 23d broke up the ice in Mackinac Strait and forced it through into Lake Michigan; on the 24th several vessels from ports on the lower lakes passed through. Although the straits were still filled with heavy drift ice the steamers encountered but little difficulty in forcing a passage.

Frankfort, Mich.: the violent westerly gale and high waves of the 4th broke up the ice in the harbor. On the 8th the lake in this vicinity was clear of ice, and the first sailing vessel of the season, the "Minnehaha," arrived from Detroit, Mich.

Traverse City, Mich.: the ice in Grand Traverse Bay broke up and moved out on the 22d.

*Lake Huron.*—Port Huron, Mich.: from the 6th to the 24th the Saint Clair River and Lake Huron, at this point, were filled with large masses of floating ice; on the 25th and 26th the ice drift was light; during the remainder of the month the river was clear. On the 12th the steamer "Atlantis" pushed her way through the ice and departed for Alpena; on the 14th the steamer "Oscoda" arrived from northern ports.

Alpena, Mich.: on the 12th the steamer "Atlantis" arrived at the mouth of Thunder Bay, but was unable to force a passage through the solid ice which covered the bay. From the 12th to 18th rainy weather prevailed, weakening the ice to such an extent that the "Atlantis" succeeded in reaching this port on the latter date.

Bay Port, Mich.: the ice in Saginaw Bay broke up the 17th.

*Lake Superior.*—Duluth, Minn.: the high westerly winds of the 28th broke up the ice at this port and moved it half a mile from the shore. On the 29th and 30th large quantities of ice were forced into this end of the lake by easterly winds.

*Lake Champlain.*—Burlington, Vt.: navigation on the lake opened on the 29th; this is the latest opening, with two exceptions, April 29, 1837, and May 1, 1875, since 1816.

## FLOODS.

Troy, N. Y.: the high temperature of the 10th had the effect of breaking up the ice in the streams to the north, the Mohawk, Hoosic, and other rivers; after 6 p. m. the Hudson River at this point was filled with floating ice and the water began rising rapidly, flooding cellars and basements along the river front. On the morning of the 11th the water was above the piers, but no serious damage was done. At Stillwater the flood carried away two sections of the bridge between that place and Schaghticoke.

Schenectady, Schenectady Co., N. Y.: unusually high temperature for April prevailed on the 10th, causing the ice in the Mohawk River to break up during the afternoon; the ice moved steadily during the night, and on the morning of the 11th the river was clear. In the vicinity of Canajoharie the flood and moving ice did considerable damage, breaking down a number of telegraph poles and injuring the abutments of the Palatine bridge. Travel on the New York Central Railroad, which follows the Mohawk River, was much impeded by the flood and ice of the 11th and 12th. At noon of the 12th the tracks from Fort Plain to Fonda were under water at some points to a depth of two feet. After the 12th the freshet subsided.

Binghamton, Broome Co., N. Y.: the maximum temperature of the air in this town and vicinity on the 10th ranged from 73° to 76°. The large amount of snow in the woods and fields about the headwaters of the Susquehanna and Chenango

rivers melted rapidly and on the 11th the rivers were high, with a swift current. On the 12th the town was nearly surrounded by the waters of the two rivers. Hundreds of cellars were flooded, and a number of mills and factories were compelled to cease operations.

Vevay, Switzerland Co., Ind.: on the 22d, at 1 a. m., a heavy storm of thunder, lightning, and rain set in and continued without intermission until the early morning of the 23d. The precipitation was large, 1.87 inches of rain falling during the first seven hours of the storm; it continued copious all day, an additional amount of 1.80 inches falling, making a total of 3.67 inches in twenty-six hours; the result was great destruction of crops from washing and overflows, with fences, sheds, and other light buildings carried away. On the 23d the Ohio River rose at the rate of twelve inches per hour, and in a number of places overflowed its banks. At New Albany, in Floyd county, the storm set in at 2 a. m. and was accompanied by an intense electrical disturbance and the heaviest rainfall that has oc-

curred in this part of Indiana since December, 1882. The streams were at flood height, carrying away bridges, and doing great damage to roads and farms. A great number of reports similar to the above have been received from stations in Kentucky, southern Illinois, Indiana, and Ohio, indicating that an unusually large amount of rain fell over the greater part of the Ohio Valley on the 22d and 23d. In Clermont county, Ohio, the Little Miami River overflowed its banks at noon of the 22d and did considerable damage. In Boyle county, Ky., the precipitation is stated to have been the heaviest that has occurred for years; Clark's Run, a small stream, was rapidly swollen to a flood which did much damage by washing away fences and the soil of recently plowed land.

Jeffersonville, Ind.: during the storm of the 22d a number of houses were flooded, the sewers not being large enough to carry off the water. The rainfall from 9 p. m. of the 21st to 9 p. m. of the 22d, 3.11 inches, was the heaviest since April 5th and 6th, 1883, when 3.14 inches fell in 12 h. and 45 m.

### ATMOSPHERIC ELECTRICITY.

#### AURORAS.

The most extensively observed aurora of the month appeared on the night of the 14-15th, but it was not brilliant and exhibited no unusual characteristics. In New England clear weather prevailed, and the display was visible at stations in this district from about 8.30 to 11.30 p. m.; at 11 p. m. the light assumed the form of a faint auroral arch, with some appearance of streamers. From New England westward over the northern part of the country to the Rocky Mountains the sky was obscured by clouds, except in portions of the upper Mississippi valley and upper lake region; in the latter districts clear or fair weather prevailed, and the aurora was noted at a number of stations. From the one hundred and twelfth meridian westward to the Pacific Ocean the sky was clear or fair, but the display was observed at two stations only, Tatoosh Island and Port Angeles, Wash., where it was quite brilliant, and was visible from 11.20 p. m. until after 2 a. m. The observers describe it as consisting of an arch of yellow light, extending from 40° east to 40° west of the magnetic meridian, the western extremity being hidden by stratus clouds. At 12.15 a. m. quivering streamers extended nearly to the zenith; these were succeeded by "merry dancers," which followed each other in rapid succession from east to west. From 1.30 to 2 a. m. the light was very brilliant, illuminating the entire northern sky.

Below are given the chief features of the more important of the remaining displays of the month:

1st-2d.—A faint light was reported from Duluth, Minn., and Poplar River, Mont.; the sky over the intervening country was obscured by clouds, but clear weather prevailed in all other parts of the country, except along the Atlantic coast. At Duluth it was visible from 9.45 p. m. until after 1 a. m.; a few streamers appeared at 11.45 p. m.

10-11th.—A faint aurora was visible at Escanaba, Mich., from 8.30 p. m. until after 1 a. m., when clouds obscured it. The sky was generally cloudy in the Lake region and westward.

11-12th.—Reported from a number of stations in New England; from thence westward in the northern districts of the country cloudy weather, with rain or snow, prevailed. This display was quite brilliant at Mount Washington, N. H., where it was first noted between 10 and 11 p. m., in the form of an arch. Waves of light moved rapidly from east to west, and streamers rose from the western extremity of the arch to an altitude of 70°; the streamers were very slender but remarkably distinct, the edges being unusually well defined. The lower part of the arch was of a yellow color, gradually becoming light green on the upper side.

15-16th.—The auroral light was noted at several stations on the night of the 15-16th, through breaks in the clouds which covered the sky from Dakota eastward; at Fort Totten, Dak.,

it appeared in the form of a faint arch, and was visible from 11 p. m. to 12.30 a. m.

18th.—An aurora of moderate brilliancy was noted at stations in northern Michigan. Clear weather prevailed in the Lake region, but rain or snow in districts to the east and west. The light was visible from 9.25 to 10.20 p. m., and consisted of an arch of white light extending 10° above the horizon and from azimuth 140° to 210°. A few streamers appeared.

19-20th.—On this date a faint display was visible at Marquette, Mich., Fort Totten, Dak., Saint Vincent, Minn., and Poplar River, Mont., from 11 p. m. until after midnight; the sky was clear or fair in all districts except the upper Mississippi valley. The observer at Marquette, Mich., describes this aurora as being quite brilliant and in the form of an arch extending from azimuth 130° to 220°. The display was accompanied by "merry dancers" and streamers of various lengths, some reaching to within 15° of the zenith.

23d-24th.—This display was of moderate brilliancy but was generally obscured by the clouds which covered the sky over the northern districts. It was reported from Eastport, Me., Lyons, N. Y., Cresco, Iowa, Alpena, Mich., and Poplar River, Mont. At Alpena, Mich., it was visible from 8.30 p. m. until after midnight, and consisted of a diffused light resting on a dark segment, and extending about 35° east and west of north. At 9 p. m. faint streamers were noticed shooting up from all points of the aurora, having an apparent motion from east to west. The display reached its maximum brilliancy at 10 p. m.

25th.—Reported from Moorhead, Minn., only, although clear or fair weather prevailed over the Lakes, Missouri Valley, and upper Mississippi valley. The aurora was visible from 1 a. m. until dawn; it first appeared as a long, white arch extending from east to west across the northern horizon. At 1.30 a. m. numerous streamers appeared at its western edge.

28th.—On this date a faint auroral arch was noted at Marquette, Mich., and Duluth, Minn.; at the same time rain or snow was falling over all districts toward the east; in the north-western districts the sky was clear or fair.

#### THUNDER-STORMS.

Thunder-storms were reported from some part of the various states and territories on the following dates:

Alabama.—7th, 18th, 21st, 22d, 23d.

Arizona.—8th, 14th.

Arkansas.—4th, 6th, 14th, 17th, 21st, 22d, 26th, 27th, 30th.

California.—10th, 29th.

Colorado.—10th, 11th, 13th, 16th, 17th, 20th.

Connecticut.—18th, 23d, 29th.

Dakota.—1st, 8th to 11th, 13th, 28th, 29th, 30th.

Delaware.—15th, 18th, 26th.